

HOT IRON #129: May, 2025

THE JOURNAL OF THE CONSTRUCTOR'S CLUB

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Our wonderful hobby includes participants with a great deal of electronic knowledge as well as those just beginning their journey. Some prefer digital modes and projects, others prefer analog projects and devices that glow in the dark. Our quarterly newsletter, begun by G3PCJ, tries to publish a little something for each, while trying to keep the focus on construction of various devices!

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* If you haven't visited the [Internet Archive](#), do so soon! It contains a huge DLARC library – just enter DLARC in the website's search box and you can find copies of almost all ham radio magazines. [Amateur Radio Weekly #365](#) contains a link to [Zero Retries #184](#) where Kay Savetz, K6KJN, has an informative write-up that lists some of the additions made to the Internet Archive DLARC library. Check it out!

* [Great News about Sunspot Cycles:](#) Solar Cycle 26 (which peaks in 2036) is expected to be better than the present cycle #25, and future ones may even be stronger. Read about the 100-year Gleissberg sunspot cycle at the link above. [Amateur Radio Weekly](#) has reported this information to us.

* [VE3IPS has a nice article about QRP operating: read it here.](#)

* There is increased QRP and vintage gear activity in the 7100 – 7120 kHz segment...check it out when you fire up your old or homebrew gear.

* [Whatever Happened to Heathkit?](#) A video about the company's beginning, success, and ending.

* [Amateur Radio Weekly #368](#) has an interesting article about massive Starlink deactivations. Find the link to ARW in the "Standard" section, found at the end of this newsletter. There is much more in that issue; have a look.

* Batteries: Ever wonder what the codes on the terminals of your power tool's battery mean? Peter provides the answer, below, which has also been added to [Hot Iron's "Reference Data" page](#).

Power tool Battery Terminal Markings:

Power tool battery terminals typically serve specific functions, and the labeling can vary depending on the manufacturer and model. However, here's a general breakdown of what the terminals might represent:

LD (Load): This terminal is typically connected to the load side of the battery. It allows the flow of current to power the device or tool.

LS (Load Sense): This terminal may be used for sensing the load on the battery. It can help in the management of the battery system to optimize performance.

LE (Load Enable): This terminal is likely used to enable or disable the load. It may signal when the battery is ready to provide power to the tool.

T (Temperature): This terminal is often used to monitor battery temperature. It can be critical for battery management systems to prevent overheating.

C+ (Charge Positive): This is generally the positive terminal for charging the battery. It connects to the positive side of a charger.

+ (Positive Terminal): This is the main positive terminal of the battery, used for both providing power to the tool and charging.

- (Negative Terminal): This is the main negative terminal of the battery, completing the circuit for both powering the tool and charging.

* **Antennas:** Too much cannot be said about the L.B. Cebik (W4RNL, SK) series of antenna articles and knowledge. [If you are considering building a new antenna, read his works here](#), but I warn you, the subject is a rabbit hole. [More information and links are available here](#).

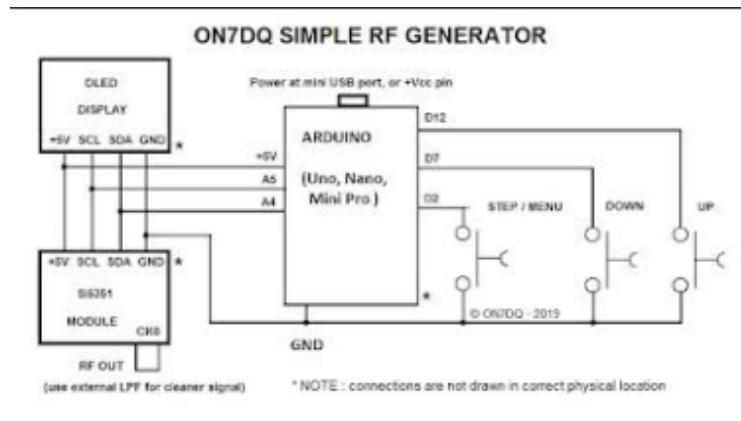
* **Speaking of antennas:** [“How can a lossy wire on the ground work better than a quarter wave vertical antenna?”](#) VA3KOT explains how sometimes, it can. And it doesn't get much simpler than this! Remember that this depends to a great extent on how lossy your soil is – dry sandy soils are best; wet, clay ones are more lossy.

* Excessive receiver noise from all our electronic gadgets? If the noise floor is too high due to all the interference radiated by our devices, [try a receiving loop-on-ground](#). Easy to install and provides a lower noise floor. W4NPN has a 400 foot on-ground “loop” that is very quiet compared to the noise level obtained from his 144 foot triangular vertical delta “loop.” You can try transmitting from it also. The results might be OK for certain distances but might be surprising. NVIS? Earth worm warmer? Worth a try, though! Send us your results if you do it.

PROJECT SECTION:

- * [Elektor Magazine has 51 pages of projects](#); over 500 in total, to keep you busy this hot summer and the coming cold winter.
- * The last Elektor issue mentioned using a [WWII surplus BC or LM Heterodyne Frequency Meter](#) as a VFO. These might be the epitome of boat anchors and they output about 17 microwatts. Peter has provided an Arduino-based RF generator design by ON7DQ which will probably fit in your pocket

and the components should be readily available. It's a tad smaller than the BC-221...Here it is:



- * If you want to know more about these [famous Heterodyne Frequency Meters](#), [go to this link](#).
- * Many of us build power supplies for our transmitters and other projects. The W4NPN website power supply page includes a document reviewing some [safety and design considerations](#) that might be of help when building one. Comments are welcome.
- * **Let's talk about some different CW keyers and keys:** Peter's idea (below) uses your body's capacitance...or inductance...or electrical charge...or a magical something; here it is:

The simplest Morse key ever? The 'Goldfinger':

"Years ago we alloyed indium pellets (0.20 mm diameter) into Gallium Arsenide dies to make - - - sorry, the Official Secrets Act prevents further description - - - the 'devices of interest'. The alloyer heater strip power supply had to sense the operator's hand contacting the control paddles, so it couldn't be inadvertently left energised, and the forming gas flowing.

Using the conductivity of the human body, the girls working on the alloyers soon found they only need the slightest touch on the paddles - fitted with gold edge connector contact strips on which all the 'fingers' were connected in parallel with a soldered strand of fine wire behind the exposed contacts, salvaged from scrapped PCB's, prevented bad contact due to oxidation; a wipe clean with a WD40 dosed cloth was all the maintenance required, every now and then.

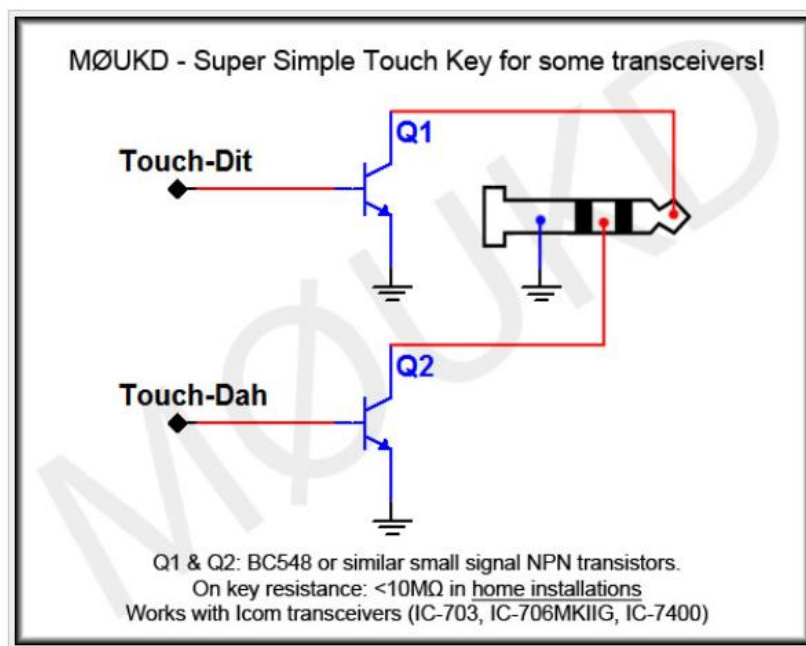
One paddle had a 1M bias resistor connected to an ultra safe double isolated 12 volt DC power supply (or a 9 volt battery perhaps?); the other paddle to the base of triple Darlington connected transistors, with a 10M resistor pull down to prevent static or 50Hz mains pick-up triggering the heaters. The gold fingers eventually wore out but the circuit still worked for a good few weeks.

No reason why it couldn't be adapted to amateur radio Morse keying. You could use the triple Darlington approach; or maybe a modern C-MOS gate, with it's incredibly high input resistance - it's up to you and what you have to hand. Speed of keying may be an issue but this is *amateur* radio, not the military or emergency service - where in any case lightning Morse is NOT a requirement! Just alter the bias / pull down resistors to suit – the lower the values, the faster the possible keying. I'd recommend battery power for absolute safety.

A modern C-MOS gate input (or supa-doooper op-amp) might even be able to sense the connection between left and right hand with much higher bias resistors; cut and try!"

-----End of article.-----

Next – another keyer: Did you know that your body is electronic? Perhaps it is a crude inductance-driven radiator of some kind. MØUKD provides a keyer circuit that uses the 50/60 hertz radiated into your body by all the home wiring, to trigger your transmitter (some transmitters, that is). [The diagram is below but read his article at this link.](#) There are other variations on this design, search the internet for them.



* Speaking of things Morse, [VK3YE shows us how to make a usable key](#) from a broken hacksaw blade. This really works – Frank built one about 65 years ago and it worked!. Send us your design for a simple key or keyer.

* [Here's another home made key; a bit more sophisticated but quite doable.](#)

* [Here's yet another one; made from a clothes pin.](#) The ideas are endless; what's yours?

THE REPRINT SECTION:

In *Hot Iron* #13, G3PCJ wrote an excellent article about simple ways to provide power supply protection. [Use this link to open a web page about power supplies and select the "Power Supply Protection – G3PCJ" menu choice.](#)

* **End Fed Antennas** of various types continue to be a "hot" subject in many amateur publications but very little information about possible problems with them has been seen. The article below was published in the last century (*Hot Iron* Summer, 1994) and it explains solutions for common problems with these or similar antennas:

End fed aerials and transmitter earthing. The following are comments from G0PCQ and G4RFU who both had trouble with the Yeovil RF PA when using end fed aerials. Eric Godfrey G3GC, who is my antenna adviser kindly produced the following notes. "End fed aerials are one of the simplest aerials for the amateur, having one end attached to the receiver and/or transmitter, and the other connected to an insulator which in turn is attached to some suitable "sky-hook" such as a tree. However there are many potential problems with using such aerials for transmitting of which transmitter earthing is probably the most important and which I will discuss in this note. An essential requirement of end fed wires is that the transmitter should be earthed for RF. This can be a problem if like many amateurs, probably the majority, you operate from the first floor or higher in a house or block of flats. The problem is to get a good RF earth for the equipment; connecting the transmitter to the earth pin of the three pin mains plug whilst ensuring that the transmitter is at earth potential as far as the mains are concerned, does nothing towards achieving this at RF. In fact the wandering earth wire of the mains wiring effectively becomes part of the aerial system as does the transmitter itself (Fig 1). This induces RF into the mains and can be a major cause of interference with your own and neighbouring domestic equipment. It can also be the source of RF feedback, general instability problems and a "hot" key or microphone with the possibility of RF burns when using high power. Even a copper earth busbar, such as used for lightning conductors, from the shack to earth will seldom provide a good RF earth and will still operate as part of the aerial system. So the problem is to get a good RF earth at the transmitter. How do we do this? The answer is to use what has become known as a counterpoise at HF. This is a length of wire attached to the earth terminal of the transmitter and extending down the garden often under the aerial although this is not absolutely necessary. Ideally this wire will be a quarter of a wavelength long at the operating frequency. Variants of this are a common sight at VHF where there are often three or four such wires in the form of rods forming a "ground plane" for a vertical aerial and are referred to as radials or "earth bars". The quarter wave wire or rod works on the principle that they and the ground form a transmission line and that the far end of this wire, which is not connected to

anything, is open circuit with respect to earth. It is a physical fact that an open circuit transmission line an odd number of quarter waves long, in this case one, will appear to be a short circuit at its input. Thus the transmitter earth terminal at the input to the wire now appears to be short circuited to earth and therefore the transmitter is at earth potential with respect to RF. Since at the next harmonically related band (say 7 MHz with respect to 3.5 MHz) the wire is now a half wave long it will no longer provide an earth for the transmitter. In fact it will ensure that it is open circuit or very high impedance since the input impedance of a transmission line, any number of half waves long, is the same as its terminating impedance, which in this case is an open circuit. In a similar manner to nested dipoles, two or three quarter waves may be joined together in parallel to allow for multi-band working (Fig 2). There is one case where two band working with just one wire is possible and that is on 7 MHz and 21 MHz where the frequency ratio is 3:1. This means that a wire cut for a quarter wave on 7 MHz will be three quarter waves on 21 MHz and therefore still present an RF short circuit to earth at the transmitter earth terminal. The input impedance seen by the transmitter will depend on the length of the aerial. Quite often this will have been cut to length but frequently it will be some random length dictated by the garden dimensions. This means that some form of impedance matching unit will have to be employed in the shack to match the aerial to the transmitter. It is essential that not only is this of good quality but also that it is capable of transforming a wide range of impedances to the transmitter's requirement which is usually 50 Ohms. In many cases it is better to have a home brew dedicated matching unit rather than a commercial "universal" one. However, aerial matching units is another subject! (Yes please - hint hint - Ed!) Undoubtedly, if there are problems in feeding or matching an end fed wire aerial then there is a high probability that the solution will be in providing a good RF earth for the transmitter."

[Here's a "Ham Radio Outside the Box" article discussing matching to EFHW antennas.](#)

[And here is yet another way to match an EFHW antenna!](#)

* **Magnetic Amplifiers!** A rarely discussed and rarely seen type of amplifier. An article by Peter, G6NGR, explains them, [see Hot Iron #110 for the original article:](#)

Mag Amps...

'Mag Amps' as they are known in the trade, are a means of controlling DC and AC power by utilising the magnetic properties of transformers. These amplifiers can run mA's to 10's (if not hundreds) of amps; voltages running to many 10's of kV. This is territory no MOSFET or bipolar transistor dare venture: even the most robust silicon diodes quiver when faced with the operating parameters mag-amps run without batting an eyelid. This is the realm of true high power electronics.

A magnetic amplifier, which only one in a thousand has heard of, let alone used, is a most reliable beast, oft used where ultra-reliability is a must as in aviation and space jobs. I first

met these beasts when fault finding a 15kV 5 Amp DC power supply which had to be regulated as best as possible, feeding a load which had a remarkable propensity for flashing over and going short circuit - the crucible supply in an electron beam aluminium evaporator, used to form the gate structures on power MOSFET wafers. The anode voltage had to be regulated within an inch of its life so the electron beam hit the water cooled crucible holding the ultra-pure aluminium pellets exactly dead centre; this to eliminate any chance of burning a hole in the crucible. Running 15kV at 5 amps is 45kW; this is enough power to punch through anything in its way within seconds, and thus cause massive contamination of the process chamber which ran at as best a vacuum as could be produced: 2×10^{-7} or better.

I traced the control signal from the beam sensing circuits to what looked like a jumbo power transformer: 0 - +24 volts on the control terminals controlled the amps in the load circuit. I checked the AC input: this looked a bit low, using a meter on volts so the EHT probe and 'scope were pressed into service: yes, the 3 phase rectifier(s) looked to be prime suspects as the output had hefty 'lumps missing', thus the mag-amp was being fed poor DC. I'd never diagnosed a mag-amp before and a quick chat with Stan as to the relationship between control volts and output volts was definitely in order.

'Dead simple, Peter: More DC volts on the control winding makes more output volts' sayeth the sage Stan. My mind raced: A transformer? Windings? On DC regulation and control? Really?

'This is certainly the case, young wazzock' sayeth the Stan; 'check those oil cooled rectifiers and I'll bet you find a dud string, but rather you than me...'

I soon knew why. Up to my elbows in transformer oil working a spanner completely out of view in turgid tranny oil is not a good idea; neither was the reception I got on going home that night with clothes that reeked and were doused liberally with sludgy oil. Long story sideways: the night shift (thanks, Bob W.) got the new rectifier stack in, after draining all the old oil (why didn't I see the drain plug, securely disguised and hidden below?) and cleaning out the tank. I ran up a test beam to 15.3kV at 5.2amps, the job's a good 'un, hand over the evaporator to Process / Production.

I read up on mag-amps; they are amazing devices and well worth investigating. You don't need fancy 'special' transformers; a few ordinary power supply trannies will work a treat,

certainly up to high audio frequencies - then I discovered somebody had trod the path out

before me. Enter Nyle Steiner, K7NS, at <http://sparkbangbuzz.com/mag-amp/mag-amp.htm> and behold the magnificent mag-amp in all it's glory!

Another reference that's useful is <https://www.eeeguide.com/magnetic-amplifier-working-principle-and-applications/>

You will find lots more information at the above links.

You can also [go here for an explanation of what mag amps are and how they work](#).

[Here's another good reference.](#)

[Here is the Wikipedia explanation.](#)

[Here is a research paper that touches on RF applications of mag amps.](#)

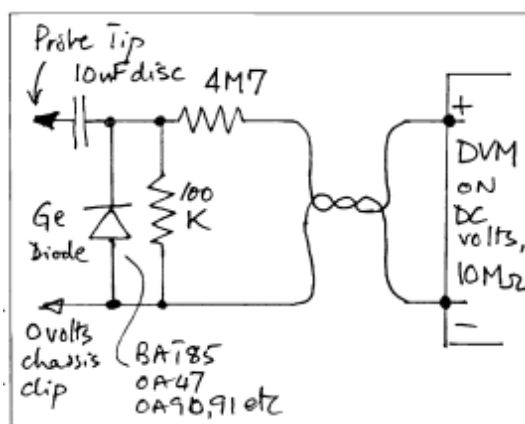
Who can provide a 40 meter KW or better mag amp circuit?

Home-built Test Equipment:

A Field Strength Meter can demonstrate that the xmtr/antenna system is truly radiating and can be helpful when adjusting a tuner. **The simple circuit at this link is easy to build.** A 100 or 200 ua meter will also work although the 50 ua meter shown is more sensitive. Frank has used this circuit for many years, with a 200 ua meter and it performs well, even easily detecting the RF from a little 14 watt 6L6 transmitter.

Another handy instrument is this RF voltmeter, from Tim Walford, G3PCJ, published in Hot Iron #2 (Winter, 1993) and illustrated below. A high impedance *peak reading rf voltmeter*, which when connected to a *digital voltmeter* with 10 MegOhms input impedance will show the RMS value of the voltage providing it is sinusoidal and sufficiently large for the approx. 0.1 volt drop in the diode to be ignored.

It will provide some indication for rf voltages down to tens of millivolts but the actual value shown will be way out and it can only be used as a rough indicator. It is good to VHF if the component leads are short. Tim Walford G3PCJ.



Ham Radio Clubs and Organizations:

[Burnley & District Amateur Radio Club - MX0STB](#) This club, in Lancashire, currently has 34 members and has recently acquired some surplus gear from another UK amateur.

[Raleigh Amateur Radio Society](#), located in Raleigh, NC, USA, is one of the larger U.S. clubs and holds one of the nation's largest "Hamfests" each Spring. It also holds licensing and training sessions and has a significant public service component.

GORP low-power club was formed in 1974 by Rev. George Dobbs G3RJV (SK). It is a non-profit organisation run entirely by volunteers to promote **Low Power Radio (QRP)**. Whether you have a ham license or not - everyone is welcome. The quarterly magazine **SPRAT** provides a fascinating read containing articles of varying complexity, from simple test equipment, to fully functioning radio transmitters and receivers. You can access SPRAT from the GORP website and the annual cost of membership is very inexpensive. [GORP also has a YouTube Channel at this link.](#)

[Four States QRP club](#) has ideas and features focused on QRP operations and construction.

[The Michigan QRP club](#) has a simple DC Receiver kit which might still be available.

(Let's get your club listed here - send the information to Frank at w4nnp@gmail.com!)

TIDBITS:

* William R. Hepburn runs the [**DX Info Centre Tropospheric Ducting Forecast**](#) website which provides six-day tropospheric ducting information and forecasting for those interested in exploring VHF, UHF and Microwave DX through the use of these ducting channels. These have the necessary atmospheric conditions to produce tropospheric bending of the waves, which extends the range of stations well beyond normal limits. Frank has experienced some of this while living in Saudi Arabia and receiving FM stations from Israel for periods of a few hours, and also receiving a New York TV station while living in Florida.

**The Section below is a more-or-less "standard" section of the newsletter
which we hope to repeat repeat in each issue:**

- * [**AM Broadcast Coverage Night Patterns for U.S. and Canadian MW stations**](#) (created by NF8M). Pick any MW frequency and see the typical coverage areas. A unique service!
- * **Antenna Headings:** VU2NSB provides a handy tool to show compass bearings to "everywhere" once your Maidenhead grid square is entered. [**Here is the link to that handy tool.**](#)
- * **QRPpppp and WSPR allows you to check your antenna's multi-band transmitting and receiving performance.** This article by N2YCH discusses this using available software and common techniques.

* **Searching for a Net?** This website by K4HCK helps you to find one in the locality you choose.

* **Andy's (KB1OIQ) Ham Radio Linux Distribution** seeks to gather many ham apps compatible with Linux into one location. This video explains what he has done and continues to do.

Go to this web page to see Hot Iron's list of known Ham Clubs, Ham Radio Publications and YouTube Channels.
Please let us know of additional ones!

Check out the various sections of www.w4nnp.org, the website where the *Hot Iron* newsletters are hosted. There is much more there! Another rabbit hole.

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